IS : 1644 - 1988
(Reaffirmed 1998)

Indian Standard

CODE OF PRACTICE FOR FIRE SAFETY OF BUILDINGS (GENERAL): EXIT REQUIREMENTS AND PERSONAL HAZARD

(First Revision)

First Reprint JANUARY 1996

UDC 699·81 : 692·622·14

BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

Gr 5

December 1988

Indian Standard

CODE OF PRACTICE FOR FIRE SAFETY OF BUILDINGS (GENERAL): EXIT REQUIREMENTS AND PERSONAL HAZARD

(First Revision)

0. FOREWORD

0.1 This Indian Standard (First Revision) was adopted by the Bureau of Indian Standards on 16 May 1988, after the draft finalized by the Fire Safety Sectional Committee had been approved by the Civil Engineering Division Council.

0.2 Indian Standards relating to fire safety of buildings have been formulated covering general principles and fire grading, details of construction, exposure hazard and exit requirements. This standard covering the last aspect was formulated in 1960. In the past 25 years, useful data has been made available by the research institutes of this country as well as from other advanced countries like USA, UK, Canada, etc. The provision in this revision has, therefore, been made based on the data adopted by these countries, and therefore, have been completed modified.

0.3 The exit requirements and personal hazard dealt with in this standard is considered as at least of equal importance to all other aspects; in fact in most cases, it is paramount because of the density of population associated with particular occupancy; an example is that of a cinema or similar densely occupied building when contrasted with a godown of similar occupancy.

0.4 Density of population varies from one building to another and also in the same building from time to time; one example is that of a large general or mixed bazar, emporium or stores where a great variety of goods are displayed for sale; and at certain periods may be offered at special attractive bargain prices, with the result that normal population will be rapidly exceeded, more so during peak shopping hours when an outbreak of fire would cause considerable confusion, possibly panic; therefore, the closet attention to design and maintenance of escape routes including any staircases, cannot be overemphasized. Likewise special consideration is essential to arrangement of display of any highly flammable articles or materials for sale in such risks because of the danger normal escape routes being made unsafe or altogether useless.

0.5 It would be neither possible nor advisable to rely on electrical or mechanical devices, such as lifts for moving the population of various floors to a place of safety because of the probability of fire rendering these devices inoperative. Therefore, staircases with associated escape routes become all important and staircases considered in this code are the means of communication in an up and down direction of a building and serve not only as escape routes for occupants but also afford a direct means of access to the source of fire by the fire fighting staff. In fact, staircase landings of buildings which present a serious hazard are required to have fire fighting equipment mounted thereon comprising hydrant stand, pipes and accessories.

0.6 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS : 2-1960*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

*Rules for rounding off numerical values (*revised*).

1. SCOPE

1.1 This standard covers requirements regarding fire safety of buildings with respect to exit requirements and personal hazard.

2. EXIT REQUIREMENTS

2.1 Ample provision for escape of population of a building when on fire is vital and all routes should be constructed to ensure that the population reaches a place of safety in the shortest period of time without undue hindrance by smoke, fumes, debris and the like.

Every building meant for human occupancy should be provided with exits sufficient to permit

safe escape of occupants, in case of fire or other emergency.

2.2 Types of Exits

2.2.1 An exit may be a doorway, a corridor or passageway(s) to an internal staircase, or external staircase, or to a verandah or terrace(s) which have access to the street, or roof of a building, or a refuge area. An exit may also include a horizontal exit leading to an adjoining building at the same level.

2.2.2 Lifts and escalators should not be considered as exits.

2.3 General

2.3.1 In every building, exits should comply with the minimum requirements except those not accessible for general public use.

2.3.2 All exits should be free of obstructions.

2.3.3 No building should so altered as to reduce the number, width or protection of exits to less than that required.

2.3.4 Exits should be clearly visible and the routes to reach the exit should be clearly marked and sign posted to guide the population of the floor concerned. Signs should be painted with illuminated paint.

NOTE — This provision should not apply to A-2 and A-4 occupancies up to 15 m in height (*see* 2.7.3 and 2.7.5).

2.3.5 Where necessary, adequate and reliable illumination should be provided for exits.

2.3.6 Fire check doors [*see* IS : 3614 (Part 1)-1966*] should at appropriate places along the escape routes to prevent spread of fire and smoke and particularly at the entrance to lifts and stairs where a 'funnel or flue effect' may be created, including an upward spread of fire.

2.3.7 All exits should provide continuous means of access to the exterior of a building or to an exterior open space leading to a street.

2.3.8 Exits should be so arranged that they may be reached without passing through another occupied unit.

2.4 Occupant Load — For determining the exits requirement, the number of persons within any floor area or the occupant load should be based on the actual number of occupants, but in no case less than that specified in Table 1.

2.4.1 *Mezzanine and Balcony* — The occupant load of a mezzanine floor and balcony discharging to a floor below should be added to that floor occupancy load thus established.

*Specification for fire-check doors: Part 1 Plate, metal covered and rolling type.

TABLE 1 OCCUPANT LOAD

(*Clause* 2.4)

Sl No	Group of Occupancy (*see* IS : 1641-1988*)		Occupant Load, Floor Area in m²/Person
1.	Residential	(A)	12·5
2.	Educational	(B)	4
3.	Institutional	(C)	15†
4.	Assembly:	(D)	
	a) With fixed or loose seats and dance floors		0·6†
	b) Without seating facilities including dining rooms		1·5‡
5.	Mercantile:	(F)	
	a) street floor and sales basement		3
	b) upper sale floors		
6.	Business and industrial	(E and G)	10
7.	Storage	(H)	30
8.	Hazardous	(J)	10

*Code of practice for the safety of buildings (general): General principles of fire grading and classifications (*first revision*).

†Occupant load in dormitory portions of homes for the aged, orphanages, insane asylums etc, where sleeping accommodation is provided, should be calculated at not less than 7·5 m² gross floor area/person.

‡The gross floor area should include, in addition to the main assembly room or space, any occupied connecting room or space in the same storey or in the storeys above or below where entrance is common to such rooms and spaces and they are available for use by the occupants of the assembly place. No deductions should be made in the gross area for corridors, closets or other subdivisions; the area should include all space serving the particular assembly occupancy.

2.5 Capacity of Exits

2.5.1 The unit of exit width, used to measure the capacity of any exit, should be 50 cm. A clear width of 25 cm should be counted as an additional half unit. Clear widths less than 25 cm should not be counted for exit width.

2.5.2 Occupants per unit exit width should be in accordance with Table 2.

2.5.3 *Horizontal Exit Allowance* — When horizontal exit is provided in buildings of mercantile, storage, industrial, business and assembly occupancies, the capacity per storey per unit width of exit of stairways in Table 2 may be increased by 50 percent; and in buildings of institutional occupancy, it may be increased by 100 percent.

2.6 Arrangement of Exits

2.6.1 Exits should be so located that the travel distance on floor should not exceed the distance given in Table 3.

2.6.2 The travel distance to an exit from the dead end of a corridor should not exceed half the distance specified in Table 3, except in educational,

TABLE 2 OCCUPANTS PER UNIT EXIT WIDTH

(*Clauses* 2.5.2 *and* 2.5.3)

Sl No.	Group of Occupancy (*See* IS : 1641-1988*)	Number of Occupants		
		Stairways	Ramps	Doors
(1)	(2)	(3)	(4)	(5)
1.	Residential (A)	25	50	75
2.	Educational (B)	25	50	75
3.	Institutional (C)	25	50	75
4.	Assembly (D)	40	50	60
5.	Business (E)	50	60	75
6.	Mercantile (F)	50	60	75
7.	Industrial (G)	50	60	75
8.	Storage (H)	50	60	75
9.	Hazardous (J)	25	30	40

*Code of practice for safety of buildings (general): General principles of fire grading and classification (*first revision*).

assemby and institutional occupancies in which case it should not exceed 6 m.

2.6.3 Whenever more than one exit is required for any room, space or floor of a building, exits should be placed as remote from each other as possible and should be arranged to provide direct access in separate directions from any point in the area served.

TABLE 3 TRAVEL DISTANCE FOR OCCUPANCY AND TYPE OF CONSTRUCTION

(*Clauses* 2.6.1 *and* 2.6.2)

Sl No.	Group of Occupancy (*see* IS : 1641-1988*)	Maximum Travel Distance Construction (*see* IS : 1642-1988 †)	
		Type 1 and 2	Type 3 and 4
(1)	(2)	(3)	(4)
		m	m
1.	Residential (A)	22 5	22·5
2.	Educational (B)	22·5	22·5
3.	Institutional (C)	22·5	22·5
4.	Assembly (D)	30·0	30·0
5.	Business (E)	30·0	30·0
6.	Mercantile (F)	30·0	30·0
7.	Industrial (G)	45·0	30·0
8.	Storage (H)	30 0	30·0
9.	Hazardous (J)	22·5	22·5

*Code of practice for fire safety of builders (general): General principles of fire grading and classification (*first revision*).

†Code of practice for fire safety of buildings (general): Details of construction (*first revision*).

2.7 Number of Exists

2.7.1 *General Requirement* — All buildings which are more than 15 m in height and all buildings used as educational (B), assembly (D), institutional (F), industrial (G), Storage (H), and hazardous (J) occupancies and mixed occupancies with any of the aforesaid occupancies, having area more than 500 m^2 on each floor should have a minimum two staircases. They should be of enclosed type; at least one of them should be on external walls of buildings and should open directly to the exterior, interior open space or to an open place of safety. Further, the provision or otherwise of alternative staircase should be subject to the requirements of travel distance being complied with.

2.7.2 *Rooming Houses of Residential Buildings (A-1)* — Every sleeping room above the street floor should have access to two separate means of exit, at least one of which should consist of an enclosed interior stairway or an exterior stairway, or a fire escape or horizontal exit, all so arranged as to provide a safe path of travel to the outside of the building without traversing any corridor or space exposed to an unprotected vertical opening. Any sleeping room below the street floor should have direct access to the outside of the building.

2.7.3 *One or Two Family Private Dwellings or Residential Building (A-2)*

2.7.3.1 For more than two rooms, every occupied room excluding areas used solely for storage, should have at least two means of exit, at least one of which should be a door or a stairway providing a means of unobstructed travel to the outside of the building or street or grade level and not more than one of which may be a window. No room or space should be occupied which is accessible only be a ladder, folding stairs or through a trap door.

2.7.3.2 All locking devices which would impede or prohibit exit, such as chain type bolts, limited opening sliding type locks and burglar locks which are not disengaged easily by quick-releasing catches, should be prohibited. All closet door latches should be such that even children may open the doors from inside. All bathroom door locks or fasteners should be designed to permit the opening of the locked or closed door from the outside in an emergency without the use of a special key. Every below-street-level sleeping room should have direct access to the outside of the building.

2.7.4 *Dormitories (A-3)* — All dormitories, except those mentioned in **2.7.6** should have exits so arranged that from any sleeping room or open dormitory sleeping area, there should be access to two separate and distinct exits in different directions with no common path of travel unless the room or space is subject to occupancy by not more than 10 persons and has a door opening directly to the outside of the building at street or grade level, or to an outside stairway in which case one means of exit may be accepted.

2.7.5 *Apartment House (A-4)*

2.7.5.1 Every individual living unit should comply with the requirements for occupancy subdivision A-2 in respect of exit (*see* **2.7.3**),

2.7.5.2 Every living unit should have access to at least two separate exits which are remote from each other and are reached by travel in different directions except that a common path of travel may be permitted for the first 6 m (that is, a dead-end corridor up to 6 m long may be permitted) provided that single exit may be permitted under any of the conditions given in **2.7.5.3.**

2.7.5.3 Any building not more than two storeys in height with no basement, or in case there is a basement and with street floor level not more than 2·5 m above ground at any point next to the building, excluding driveways, not more than 10 percent of the perimeter should be subject to the condition that the access to the basement is only from the exterior of the building if the basement contains a heating plant, group storage, incinerator room or paint shop or other hazardous occupancy.

2.7.5.4 At least half of required exits should discharge direct to the outside of the buildings; any other exit should be the same as required for the hotels (*see* **2.7.6**).

2.7.6 *Hotels* (*A-5*)

2.7.6.1 Not less than two exits, as remote from each other as practicable, should be accessible from every floor, including basements occupied for hotel purposes, except as a single exit as permitted in **2.7.6.2** below. Exits and ways of access thereto should be so arranged that they are accessible in at least two different directions from every point in any open area, or from any room door.

2.7.6.2 Any room or section with an outside door at street or grade level may have such outside door as a single exit provided no part of the room or area is more than 15 m from the door measured along the natural path of travel.

2.7.6.3 Where stairways or other exits serve two or more upper floors, the same stairway or other exit required to serve any one upper floor may also serve other upper floors except that no inside open stair-way or ramp may serve as a required egress facility from more than one floor.

NOTE — Under this provision, if the second and third floors were each required to have three stairways, the second floor may use the stairways serving the third floor so that the total number of stairways required is three, and not six.

2.7.7 *Basement Exits for Residential Buildings* (*A*)

2.7.7.1 Basements occupied for hotel purposes should have exits arranged in accordance with **2.7.6**

2.7.7.2 Basement exits should be sufficient to provide for the capacity of the basement as determined in accordance with **2.3** and in no case should there be less than two independent basement exits.

2.7.7.3 Basements or sub-basements not open to the public and used only for heating equipment, storage and service operations (other than kitchens which are considered part of the hotel occupancy) should have exits appropriate to the actual occupancy, in accordance with applicable provisions or in case of mixed occupancy where there may be doubt as to which other section is applicable, such basements should have exits determined on the basis of lesser exit capacity.

2.7.8 *Educational* (*B*)

2.7.8.1 At least two separate exits are available in every floor area. Exits should be as remote from each other as practicable and so arranged that there are no pockets or dead ends of appreciable size in which occupants may be trapped.

2.7.8.2 Every room with a capacity of over 100 persons in area should have at least two doorways as remote from each other as practicable. Such doorways should provide access to separate exits but may open upon a common corridor leading to separate exits in opposite directions.

2.7.8.3 Exterior doors should be operated by bars or some other panic hardware device except that doors leading from classroom directly to the outside may be equipped with the same type of lock as is used on classroom doors leading to corridor with no provision whatsoever for locking against egress from the classroom.

2.7.9 *Institutional* (*C*)

2.7.9.1 In buildings or sections occupied by bedridden patients where the floor area is over 280 m^2, facilities should be provided to move patients in hospital beds to the other side of a smoke barrier from any part of such building or section not directly served by approved horizontal exits or exits from the first floor (Floor 2) of a building to the outside.

2.7.9.2 Not less than two exits of one or more of the following types should be provided for every floor, including basement, of every building or section:

a) Doors leading directly outside the building,
b) Stairways,
c) Ramps, and
d) Horizontal exits.

2.7.9.3 All required exits which serve as egress from hospital or infirmary sections should be not less than 150 cm in clear width, including patient bedroom doors, to permit transportation of patients on beds, litters or mattresses. The minimum widths of corridors serving patients bedrooms in building should be 240 cm.

2.7.9.4 Revolving doors should not be counted as required exits and should not be installed, except in situations, such as revolving doors at a main entrance where they are not subject to emergency exit use by patients.

2.7.9.5 Elevators constitute a desirable supplementary facility but are not counted as required exits.

2.7.9.6 Each storey in which 35 or more patients are housed should be divided into at least two compartments by smoke barriers and the Authority may require storeys housing a lesser number of patients to be divided into compartments when, in its judgement, such division is essential for the protection of the patients.

2.7.9.7 Doors in smoke barriers should be so installed that these may normally be kept in open position but will close automatically or may be released manually to self-closing action. Corridor door openings in smoke barriers should not be less than 150 cm in width. Provision should also be made for double swing single/double leaf type door.

2.7.9.8 Exits and other features for penal and mental institutions, and custodial institutions should be the same as specified for hospitals, in so far as applicable. Reliable means should be provided to permit the prompt release of inmates from any locked section in case of fire or other emergency.

2.7.9.9 Wherever any inmates are confined in any locked rooms or spaces, adequate guards or other personnel should be continuously on duty or immediately available to provide for release of inmates or for such other action as may be indicated in case of fire or other emergency.

2.7.9.10 No building constructed in whole or in part of combustible materials should be used to combine inmates in cells or sleeping quarters unless automatic sprinkler protection is provided.

2.7.9.11 All buildings or sections of build ings penal and mental institutions used for manufacturing, storage or office purposes should have exits in accordance with the provisions of occupancies.

2.7.10 *Assembly Buildings (D)*

2.7.10.1 Every place of assembly, every tier or balcony, and every individual room used as a place of assembly should have exits sufficient to provide for the total capacity thereof as determined in accordance with **2.7.7.**

2.7.10.2 Every place of assembly of subdivision D-1 should have at least four separate exits as remote from each other as practicable.

2.7.10.3 Every place of assembly of subdivision D-2 should have at least two separate exits remote from each other as practicable and if of capacity over 600, at three exits should be provided with each exit not less than of 2 u. it widths.

2.7.10.4 Every place of assembly of subdivisions D-3, D-4 and D-5 should have at least two means of exit, consisting of separate exits or doors leading to corridor or other spaces giving access to two separate and independent exits in different directions, except that for places of assembly having a capacity of less than 100 persons, one 2-unit doorway may be permitted in rooms where no part of the room is more than 15 m from the doorway, measured along the line of travel, and the doorway leads directly outside the building at grade level or leads to a corridor or other space giving access to two separate and independent exits.

2.7.10.5 Clear aisles not less than 1·2 m in width should be formed at right angles to the line of seating in such number and manner that no seat should be more than seven seats away from an aisle. Rows of seats opening on to an aisle at one end only should have not more than seven seats. Under the conditions where all these aisles do not directly meet the exit doors, cross-aisles should be provided parallel to the line of seating so as to provide direct access to the exit, provided that not more than one cross-aisle for every 10 rows should be required. The width of cross aisles should be a minimum of 1 m. Steps should not be placed in aisles to overcome differences in levels unless the gradient exceeds 1 in 10.

2.7.10.6 The fascia of boxes, balconies and galleries should have substantial railings not less than 65 cm high above the floor. The railings at the end aisles extending to the fascial should be not less than 75 cm high for the width of the aisle or 90 cm high at the foot of steps.

2.7.10.7 Cross-aisles except where the backs of seats on the front of the aisle project 60 cm or more above the floor of the aisle, should be provided with railings not less than 90 cm high.

2.7.10.8 No turnstiles or other devices to restrict the movement of persons should be installed in any place of assembly in such a manner as to interfere in any way with the required exit facilities.

2.7.10.9 In theatres and similar places of public assembly where persons are admitted to the building at a time when seats are not available for them and are allowed to wait in a lobby or similar space until seats are available, such use of lobby or similar space should not encroach upon the required clear width of exits. Such waiting should be restricted to areas separated from the required exitways by substantial permanent partitions or fixed rigid railing not less than 105 cm high. Exits should be provided

for such waiting spaces on the basis of one person for each 0·3 m^2 of waiting space area. Such exits should be in addition to the exits specified for the main auditorium area and should conform in construction and arrangement to the general rules of exits given above.

2.7.10.10 No display or exhibit should be so installed or operated as to interfere in any way with access to any required exit, or with any required exit sign. All displays or exhibits of combustible material or construction and all booths and temporary construction in connection with it should be so limited in combustibility or protected as to avoid any undue hazard of fire which might endanger occupants before they have opportunity to use the available exits.

2.7.10.11 No mirrors should be placed in or adjacent to any exitway in such a manner as to confuse the direction of the exit.

2.7.10.12 Places of assembly in buildings of other occupancy may use exits common to the place of assembly and other occupancy. Provided the assembly area and other occupancy are considered separately, each has exits sufficient to meet the requirements.

2.7.10.13 Exits should be sufficient for simultaneous occupancy of both the places of assembly and other parts of the building, unless the conditions are such that simultaneous occupancy will not occur.

2.7.10.14 For any place of assembly under subdivision D-1, at least half the required means of exits should lead directly outdoors or through exitways completely separated from exits serving other parts of the building.

2.7.11 *Business (E)*

2.7.11.1 In the case of mezzanines or balconies open to the floor below, or other unprotected vertical openings between floors, the population of the mazzanine or other subsidiary floor level should be added to that of the main floor for the purpose of determining the required exits, provided, however, that in no case should the total number of exits, units be less than that required if all the vertical openings were enclosed.

2.7.11.2 Not less than two exits should be provided for every floor, including basements occupied for office purposes or uses incidental thereto.

2.7.12 *Mercantile (F)*

2.7.12.1 In the case of mezzanines or balconies open to the floor below, or other unprotected vertical openings between floors, the population or area of the mezzanine or other subsidiary floor level should be added to that of the main floor for the purpose of determining the required exits, provided, however, that in no case should the total number of exits units be less than that required if all vertical openings were enclosed.

2.7.12.2 At least two separate exits should be accessible from every part of every floor, including basements; such exits should be as remote from each other as practicable and so arranged as to be reached by different paths of travel in different directions except that a common path of travel may be permitted for the first 15 m from any point.

2.7.13 *Industrial (G)*

2.7.13.1 Not less than two exits should be provided for every floor or section, including basements used for industrial purposes or uses incidental thereto.

2.7.13.2 In buildings used for aircraft assembly or other occupancy requiring undivided floor areas so large that the distance from points within the area to the nearest outside walls where exit doors could be provided are in excess of 45 m, requirements for distance to exits may be satisfied by providing stairs leading to exit tunnels or to overhead passageways. In cases where such arrangements are not practicable, permit other exit arrangements for one storey buildings with distance in excess of the maximum distances specified in **2.6**. If completely automatic sprinkler protection is provided and if the heights of ceiling curtain boards and roof ventilation are such as to minimize the possibility that employees will be overtaken by the spread of fire or smoke within 180 cm of the floor level before they have time to reach exits, provided, however, that in no case may the distance of travel to reach the nearest exit exceed 120 m where smoke venting is required as a condition for permitting distances of travel to exits in excess of the maximum otherwise allowed.

2.7.13.3 Basements used only for storage, heating and other service equipment, and not subject to industrial occupancy should have exits in accordance with the requirements of Group H occupancies.

2.7.13.4 The following exceptions should apply to special purpose industrial occupancies:

a) Exits need be provided only for the persons actually employed; spaces not subject to human occupancy because of the presence of machinery or equipment may be excluded from consideration.

b) Where unprotected vertical openings are necessary to manufacturing operations, these may be permitted beyond the limits specified for industrial occupancy provided every floor level has direct access to one or more enclosed stairways or other exits protected against obstruction by any fire in the open areas connected by the

unprotected vertical openings or smoke therefrom.

2.7.13.5 The following exceptions should apply to high hazard industrial occupancies:

a) Exits should be so located that it will not be necessary to travel more than 22·5 m from any point to reach the nearest exit.

b) From every point in every floor area, there should at least be two exits accessible in different directions; where floor areas are divided into rooms, there should be at least two ways of escape from every room, however small, except toilet rooms, so located that the points of access thereto are out of or suitably shielded from areas of high hazard.

c) In addition to types of exits for upper floors specified for Group G occupancies, slide escapes may be used as required exits for both new and existing buildings.

2.7.14 *Storage (H)*

2.7.14.1 Every building or structure used for storage, and every section thereof considered separately, should have access to at least one exit so arranged and located as to provide a suitable means of escape for any person employed therein and in any room or space exceeding 1 400 m^2 gross area, or where more than 10 persons may be normally present, at least two separate means of exit shall be available, as remote from each other as practicable.

2.7.14.2 Every storage area should have access to at least one means of exit which can be readily opened. This should not be subject to locking so long as any persons are inside and should not depend on power operation.

2.7.14.3 The following special provisions should apply to parking garages of closed or open type, above or below ground but not to mechanical parking facilities where automobiles move into and out of storage mechanically which are not normally occupied by persons and thus require no exit facilities. Where repair operations are conducted, the exits should comply with the requirements of Group G occupancies in addition to compliance with the following:

a) Where both parking and repair operations are conducted in the same building, the entire building should comply with the requirements for Group G occupancies unless the parking and repair sections are effectively separated by separation walls.

b) Every floor of every closed parking garage should have access to at least two separate means of exit so arranged that from any point in the garage, the paths of travel to the two means of exit should be in different directions, except that a common path of travel may be permitted for the first 15 m from any point.

c) On the street floor, at least two separate exit doors should be provided except that any opening for the passage of automobiles may serve as a means of exit provided no door or shutter is installed thereon. Street floor exits in closed garages should be so arranged that no point in the area is more than 30 m from the nearest exit, or 45 m in the case of garages protected by automatic sprinklers, distance being measured along the natural path of travel.

d) On floors above the street, at least two means of exit should be provided, one of which should be an enclosed stairway. The other means of egress may be a second exit of any of the types, or in a ramp type garage with open ramps not subject to closure, the ramp may serve as the second means of exit.

e) Upper floor exits in closed garages should be so arranged that no point in the area should be more than 30 m from the nearest exit other than a ramp on the same floor level, or 45 m in the case of garages protected by automatic sprinklers.

f) On floors below the street (either basement or outside underground garages), at least two exits should be provided, not counting any automobile ramps except that for garages extending only one floor level below the street, a ramp leading direct to the outside may constitute one required means of exit. In garages below street level, exits should be so arranged that no part of the area should be more than 30 m from the nearest stair exit.

g) If any gasoline pumps are located within any closed parking garage, exits should be so located that travel away from the gasoline pump in any direction should lead to an exit, with no dead-end in which the occupants might be trapped by fire or explosion at any gasoline pump. Such exit should lead to the outside of the building on the same level, or downstairs; no upward travel should be permitted unless direct outside exits are available from the floor and any floor below (as in the case of a basement garage where the grade is one storey or more lower at the rear than at the street).

2.7.14.4 Exits from aircraft hangars (storage or servicing areas) should be provided at intervals of not more than 45 m on all exterior walls of aircrafts hangars. There should be a minimum of two exits serving each aircraft storage or

servicing area. Horizontal exits through interior fire walls should be provided at intervals of not more than 30 m. 'Dwarf' or 'smash' doors in doors accommodating aircraft may be used to comply with these requirements. All doors designated as exits should be kept unlocked in the direction of exit travel while the area is occupied.

2.7.14.5 Exits from mezzanine floors in aircraft storage or servicing area should be so arranged that the maximum travel to reach the nearest exit from any point on the mezzanine should not exceed 22·5 m. Such exits should lead directly to a properly enclosed stairwell discharging directly to the exterior or to a suitably cut-off area or to outside fire escape stairs.

2.7.14.6 The following provisions should apply to grain elevators:

a) There should at least be one stair tower from basement to first floor and from first floor to top floor of the workhouse enclosed in a dust-tight non-combustible shaft;

b) Non-combustible doors of self-closing type should be provided at each floor landing;

c) An exterior fire escape of the stair or basket ladder type should be provided from the roof of the workhouse to the ground level or to the roof of an adjoining annexe with access from all floors above the first; and

d) An exterior fire escape of either the stair or basket ladder type should be provided from the roof of each storage annexe to the ground level.

2.7.14.7 Every area used for storage of hazardous commodities should have an exit within 22·5 m of any point in the area where persons may be present or 30 m where automatic sprinkler protection is provided.

2.7.15 *Hazardous (J)* — Same as in **2.7.13.5**.

2.8 Doorways

2.8.1 Every exit doorway should open into an enclosed stairway, or horizontal exit of a corridor, or passageway providing continuous and protected means of egress.

2.8.2 No exit doorway should be less than 100 cm in width. Doorways should be not less than 200 cm in height.

2.8.3 Exit doorways should open outwards, that is, away from the room but should not obstruct the travel along any exit. No door, when opened, should reduce the required width of stairway or landing to less than 90 cm; overhead or sliding door should not be installed.

NOTE — In the case of buildings where there is a central corridor, the doors of rooms should open inwards to permit smooth flow of traffic in the corridor.

2.8.4 Exit door should not open immediately upon a flight of stairs, a landing equal to at least the width of the door should be provided in the stairway at each doorway; the level of landing should be the same as that of the floor which it serves.

2.8.5 Exit doorways should be openable from the side which they serve without the use of a key.

2.8.6 *Revolving Doors*

2.8.6.1 Revolving doors should not be used as required exits except in residential, business and mercantile occupancies but should not constitute more than half the total required door width. In mercantile buildings where there is possibility of congregation of a large number of people (more than 200), revolving doors should not be permitted.

2.8.6.2 Where the revolving door provided are completely made of glass (plate glass), a red circle or emblem or logo at 1·5 m level above sill should be painted on the glass. The thickness of the glass should not be not less than 12 mm.

2.9 Corridors and Passageways

2.9.1 Exit corridors and passageways should be of width not less than the aggregate required width of exit doorways leading from them in the direction of travel to the exterior.

2.9.2 Where stairways discharge through corridors and passageways, the height of corridors and passageways should be not less than 2·4 m.

2.10 Internal Staircases

2.10.1 Interior stairs should be constructed of non-combustible materials throughout.

2.10.2 Interior staircase should be constructed as a self-contained unit with an external wall constituting at least one of its sides and should be completely enclosed.

2.10.3 A staircase should not be arranged round a lift shaft unless the latter is totally enclosed by a material of fire-resistance rating as that for the type of construction itself.

2.10.4 Hollow combustible construction should not be permitted.

2.10.5 No gas piping should be laid in the stairway.

2.10.6 Notwithstanding the detailed provision for exits given above the following minimum width should be provided for staircases:

a) Residential buildings (dwellings) 1·0 m

NOTE — For row housing with 2 storeys, the width should be 0·75 m.

b) Residential hotel buildings 1·5 m

c) Assembly buildings like auditorium, theatres and cinemas 1·5 m

d) Educational buildings:

i) Up to 24 m in height 1·5 m

ii) More than 24 m in height 2·0 m

e) Institutional buildings like hospitals:

i) Up to 10 beds 1·5 m

ii) More than 10 beds 2·0 m

f) All other buildings 1·5 m

2.10.7 The minimum width of tread without nosing should be 25 cm for internal staircase of residential buildings. This should be 30 cm for assembly, educational, institutional, business and other buildings. The treads should be constructed and maintained in a manner to prevent slipping.

2.10.8 The maximum height of riser should be 19 cm for residential buildings and 15 cm for other buildings and the number should be limited to 15 per flight.

2.10.9 Hand rails should be provided at a minimum height of 100 cm and not exceeding 120 cm to be measured from the base of the middle of the treads to the top of the hand rails. Further, the gap between the two verticals should not exceed 30 cm. This gap should be reduced to 15 cm where children are likely to use the staircase.

2.10.10 The number of people in between floor landings in staircase should not be less than the population on each floor for the purpose of design of staircase.

2.11 Fire Escapes or External Stairs

2.11.1 Fire escapes should not be taken into account in calculating the evacuation time of a building.

2.11.2 All fire escapes should be directly connected to the ground.

2.11.3 Entrance to the fire escape should be separate and remote from the internal staircase.

2.11.4 Care should be taken to ensure that the wall opening or window opens on to or close to a fire escape.

2.11.5 The route to the fire escape should be free of obstructions at all times.

2.11.6 The fire escape should be constructed of non-combustible materials, and any doorway leading to the fire escape should have the required fire resistance.

2.11.7 No staircase, used as a fire escape, should be inclined at an angle greater than 45° to the horizontal.

2.11.8 Fire escape stairs should have straight flight not less than 75 cm wide with 20 cm treads and risers not more than 19 cm. The number of risers should be limited to 15 per flight.

2.11.9 Hand rails should be of a height not less than 100 cm and not exceeding 120 cm.

2.11.10 *Spiral Fire Escape* — The use of spiral staircase should be limited to occupant load and to a building not exceeding 9 m in height unless they are connected to platforms, such as balconies and terraces to allow escapees to pause.

2.11.11 Spiral fire escape should be not less than 150 cm in diameter and should be designed to give adequate headroom.

2.12 Roof Exit — In all buildings over three storeys in height where the slope of the roof is less than 20 degrees, direct access to the roofs should be provided from the street by means of a stairway. Where roofs are used as roof gardens or for other habitable purposes, sufficient stairways should be extended to them to provide necessary exit facilities required for such an occupancy.

NOTE — This does not apply to A-2 and A-4 occupancies up to 15 m height.

2.13 Horizontal Exits

2.13.1 The width of horizontal exit should be the same as for the exit doorways (*see* **2.8**).

2.13.2 A horizontal exit should be equipped with at least one fire door of self-closing type.

2.13.3 Floor area on the opposite or refuge side of a horizontal exit should be sufficient to accommodate occupants of the floor areas served, allowing not less than 0·3 m^2/person. The refuge area into which a horizontal exit leads should be provided with exits adequate to meet the requirements given in this standard. At least one of the exits should lead directly to the exterior of building or to a street.

2.13.4 Where there is a difference in level between connected areas for horizontal exits, ramps, not more than 1 in 10 in slope should be provided; steps should not be used.

2.13.5 Doors in horizontal exits should be openable at all times from both sides.

2.14 Fire Tower — Fire towers are the preferred type of escape route for storeyed buildings and their application should be considered as the safest route for escape. Their number, location and size should depend on the building concerned, and its associated escape routes.

2.14.1 In every mercantile, industrial, business, assembly buildings other than theatres, institutional and residential buildings, over 6 storeys or 25 m in height, at least one required means of egress should be a fire tower.

2.14.2 The enclosure of fire towers should be constructed of walls with a 4 h fire-resistance rating without openings other than the exit doorways with ptatform, landings and balconies of not less than 3 h fire-resistance rating.

2.15 Ramps

2.15.1 Ramps should comply with all the applicable requirements for stairways reg ing enclosure, capacity and limiting dime: is except where specified for special uses d occupancies.

2.15.2 The slope of a ramp should not exceed 1 in 10. In certain cases, steeper slopes may be permitted but in no case greater than 1 in 8.

2.15.3 For all slopes exceeding 1 in 10 and wherever the use is such as to involve danger of slipping, the ramp should be surfaced with approved non-slipping material.

Bureau of Indian Standards

BIS is a statutory institution established under the *Bureau of Indian Standards Act, 1986* to promote harmonious development of the activities of standardization, marking and quality certification of goods and attending to connected matters in the country.

Copyright

Review of Indian Standards

Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically; a standard along with amendments is reaffirmed when such review indicates that no changes are needed; if the review indicates that changes are needed, it is taken up for revision. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition by referring to the latest issue of 'BIS Handbook' and 'Standards Monthly Additions'.

Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

BUREAU OF INDIAN STANDARDS

Headquarters:

Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi 110002
Telephones : 331 01 31, 331 13 75

Telegrams : Manaksanstha
(Common to all offices)

Regional Offices :		Telephone
Central	: Manak Bhavan, 9 Bahadur Shah Zafar Marg NEW DELHI 110002	331 01 31 331 13 75
Eastern	: 1/14 C. I.T. Scheme VII M, V. I. P. Road, Maniktola CALCUTTA 700054	37 84 99, 37 85 61 37 86 26, 37 86 62
Northern	: SCO 335-336, Sector 34-A, CHANDIGARH 160022	60 38 43 60 20 25
Southern	: C. I. T. Campus, IV Cross Road, MADRAS 600113	235 02 16, 235 04 42 235 15 19, 235 23 15
Western	: Manakalaya, E9 MIDC, Marol, Andheri (East) BOMBAY 400093	632 92 95, 632 78 58 632 78 91, 632 78 92

Branches : AHMADABAD. BANGALORE. BHOPAL. BHUBANESHWAR. COIMBATORE. FARIDABAD. GHAZIABAD. GUWAHATI. HYDERABAD. JAIPUR. KANPUR. LUCKNOW. PATNA. THIRUVANANTHAPURAM.

Reprography Unit, BIS, New Delhi, India